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INVENTOR-INFORMATION:

NAME	COUNTRY
HIRVONEN, JUHANI	FI
HAEMAELAEINEN, JARI	FI
VALTONEN, TUOVI	FI

ASSIGNEE-INFORMATION:

NAME	COUNTRY
LAENNEN TEHTAAT OY	FI

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ABSTRACT:
The invention relates to method for identifying plants qualified to be planted. In the method excitation radiation is directed to each pigeonhole containing a plant. In case there is a living plant in a pigeonhole, its pigment, especially chlorophyll, fluoresces.

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(71) Applicant *(for all designated States except US)*: LÄNNEN TEHTAAT OY [FI/FI]; Säkylä, SF-27820 Iso-Vimma (FI).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)* : HIRVONEN, Juhani [FI/FI]; Sysimiehenpolku 8 B, SF-00670 Helsinki (FI). HÄMÄLÄINEN, Jari [FI/FI]; Pihlajatie 44 B 83, SF-00270 Helsinki (FI). VALTONEN, Tuovi [FI/FI]; Väinölänkatu 17 D 34, SF-00610 Helsinki (FI).

(74) Agent: RUSKA & CO. OY; Runeberginkatu 5, SF-00100 Helsinki (FI).

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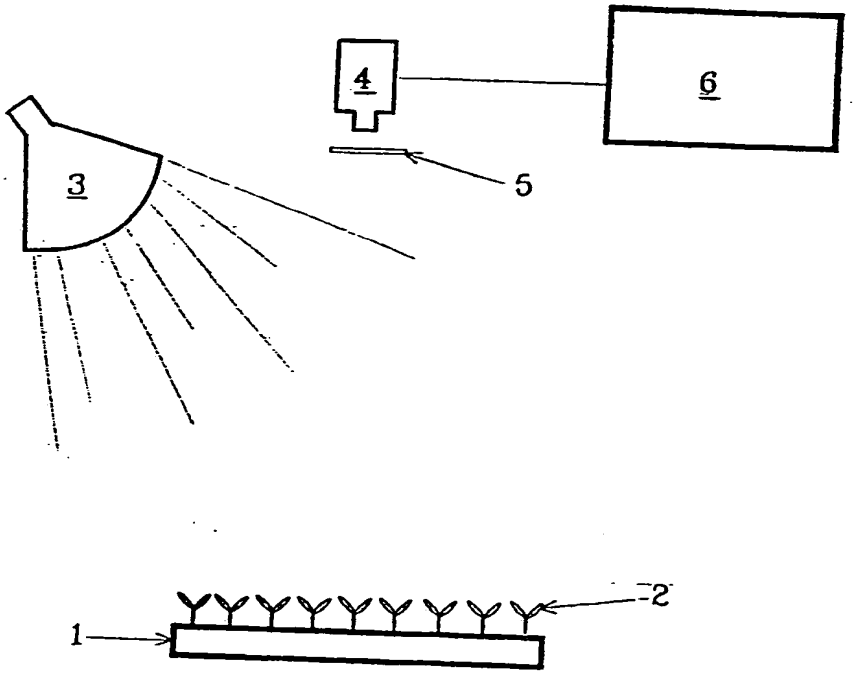

(57) Abstract

The invention relates to method for identifying plants qualified to be planted. In the method excitation radiation is directed to each pigeonhole containing a plant. In case there is a living plant in a pigeonhole, its pigment, especially chlorophyll, fluoresces.

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Method for the detection of plants

The invention relates to growing plants in honeycombs, in which there are several pigeonholes for the plants. The invention relates to method and equipment for identifying plants qualified to be planted and for separating them from those unsuitable.

Today plants are generally grown in balls in honeycombs, in which there is a separate pigeonhole to be found for each plant. After initial growing plants are then planted into their actual site, e.g. in the open or in bigger pots.

Also automatic equipment for transferring and planting the plants from honeycombs have been developed. In order to be able to use the area available most effectively, planting of empty balls or balls containing dead plants should be avoided. The actual mechanical replacing of a ball in a honeycomb with a new one is in principle quite easy to automatize. The problem is, however, how to identify automatically the balls to be replaced.

The objective of this invention is to create a system, with which the balls containing no plants can be automatically identified in honeycombs containing plants to be planted. This objective will be achieved by means described in independent claims. Some of the embodiments of the invention are described in dependent claims.

According to the invention excitation radiation is directed to each pigeonhole, which radiation stimulates a living plant to fluoresce. The possible fluorescence radiation is proven by a detector. In case in a pigeonhole there is no fluorescence to be found or its quantity is beneath a certain value, the ball in question can be removed and replaced by a new

one containing a plant qualified to be planted.

In the following an embodiment of the invention will be described in more detail. Fig. 1 is a side view of the identification of plants by fluorescence according to the invention in schematical representation.

Honeycomb 1 contains several rows of pigeonholes. The pigeonholes are filled with substrate and in each ball thus created there is a seed sowed. After growing the plants 2 with their substrate balls are transferred from the honeycomb and planted.

In the ideal case there is a living plant 2 in each pigeonhole. But in practice there are, however, always also empty balls or balls containing dead plants to be found.

According to the invention light is directed to each ball from the top from the light source 3 at wavelength range of approx. under 550 nm, most convenient wavelength range of approx. 300-550 nm. This light acts as excitation radiation for certain pigments of a living plant, especially for chlorophyll, and stimulates them to emit fluorescence radiation at wavelength range over approx. 550 nm, especially at range over approx. 600 nm.

The possible fluorescence radiation coming from each ball is detected by a camera 4 (e.g. video camera). In front of the camera there is a filter 5, which lets through only over approx. 550 nm (or over approx. 600 nm) radiation.

By the described method it is essential, that the light of the light source 3 excitates fluorescence strong enough for picture formation and that the radiation of the light source reflected directly from the plant or the substract does not reach the camera 4. Thus the fluorescence radiation emitted by the

chlorophyll of living plants is clearly to be seen in the picture, which radiation is not emitted by the background or dead plants, and thus the balls unqualified for planting can be separated.

A signal coming from the camera 4 is digitized into the computer 6. The picture is segmented, i.e. areas indicating the same target are separated e.g. by a simple threshold procedure, whereby targets darker than certain grey scale value are set black and those lighter are set white. The surface area and border line corresponding the area of the plant can easily be separated from the picture made by threshold procedure by using methods of digital graphics.

The honeycomb 1 is placed in relation to the light source 3 and the camera 4 in a manner, that each pigeonhole can be inspected. In case there is no fluorescent plant at all or in regard to its surface area insufficiently fluorescent plant, the pigeonhole in question is registered as empty into the computer. Information received can be used in the automatic machine replacing the balls, whereby each empty ball is removed and replaced by a new one containing a living plant.

Claims

1. Method for identifying and separating plants qualified for planting, which plants are placed each in its own separate pigeonhole in a honeycomb containing several of these pigeonholes, c h a r a c t e r i z e d in that excitation radiation is directed to each pigeonhole, which radiation stimulates a pigment of a living plant to fluoresce, the fluorescence radiation coming from each pigeonhole is detected and identified, that there is a plant qualified for planting in a pigeonhole, in case the fluorescence radiation detected from the pigeonhole exceeds a certain value.

2. Method as set forth in claim 1, c h a r a c t e r i z e d in that the wavelength range of the excitation radiation is beneath approx. 550 nm.

3. Method as set forth in claim 1 or 2, c h a r a c t e r i z e d in that fluorescence radiation is detected, the wavelength of which is over approx. 550 nm, preferably over approx. 600 nm.

4. Equipment for identifying and separating plants qualified for planting, which plants are placed each in its own separate pigeonhole in a honeycomb containing several of these pigeonholes, c h a r a c t e r i z e d in that the equipment consists of radiation source (3) for transmitting excitation radiation to each pigeonhole containing a plant, which radiation stimulates a pigment of a living plant to fluoresce, and of facilities (4, 5) for detecting and handling the fluorescence radiation coming from each pigeonhole.

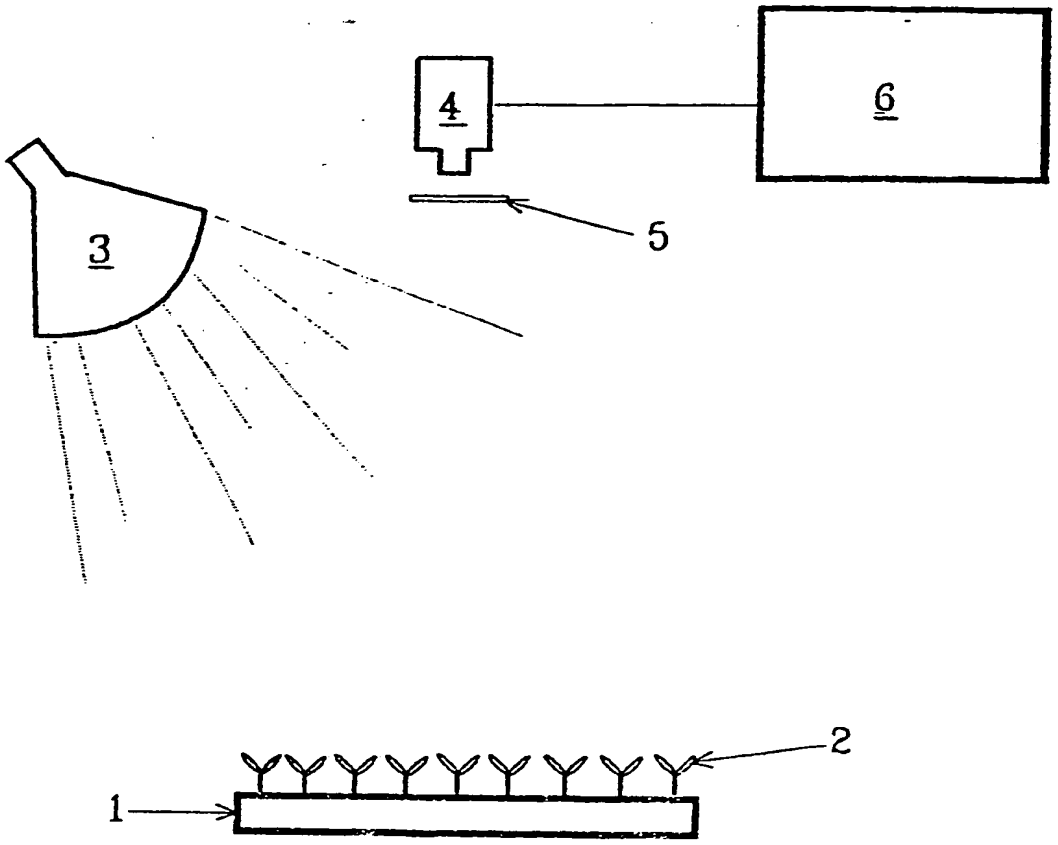

Fig.1.

INTERNATIONAL SEARCH REPORT

International Application No PCT/FI 91/00009

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: A 01 G 9/00, G 01 N 21/64

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	A 01 G; G 01 N

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	WO, A1, 8706698 (WASS, ROLAND) 5 November 1987, see the whole document --	1-4
X	DE, A1, 3518527 (SCHREIBER, ULRICH) 27 November 1986, see the whole document --	1-4
X	US, A, 4533252 (CAHEN ET AL) 6 August 1985, see the whole document --	1-4

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
15th April 1991	1991 -04- 16
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Ingrid Falk Ingrid Falk

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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.PCT/FI 91/00009

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A1- 8706698	87-11-05	NONE	
DE-A1- 3518527	86-11-27	NONE	
US-A- 4533252	85-08-06	NONE	